the other; but both are *well grown*." The latter observation is not quite correct, and it is calculated to throw some doubt upon the accuracy of Mr. Stone's words, which are, "I was fortunate in discovering a *small larva* attached to its victim." The size of the parasitic larva is 3 lines, that of the wasp $5\frac{1}{2}$; they have been in spirit since 1865, and were partially dried at the time they were immersed, so that the exact relative size cannot be ascertained; but the present difference between them justifies Mr. Stone in calling the parasitic larva small. I have carefully examined them, and am satisfied of the *Rhipiphorus*-larva being attached to the wasp-larva just below the head; there is no attachment of the rest of its body: I have separated the bodies, and proved it.

The last paragraph of the postscript is entirely suppositional. Mr. Murray has not shown me any of his specimens: I have seen no pupæ with the cast skin sticking to their tail; and if I had, I should only have seen the reverse of what Mr. Stone records, who describes the larva of *Rhipiphorus* as having its "mouth buried in the body of the wasp-larva just below the head."

Let it be distinctly understood that I admit that it is possible, but *highly improbable*, that Mr. Stone has recorded mistaken observations.

From actual observation I know nothing of the subject. I was never so fortunate as to find a nest infested by the parasite; but for some years I had the enjoyment of a close correspondence with Mr. Stone, and I know him to have been a most accurate and careful observer; and, until actual observation prove his statements to be fallacious, I shall have a firm belief in their truth.

XXI.—*Häckel on the Relationship of the Sponges to the Corals.* By Wm. S. Kent, F.Z.S., F.R.M.S., of the Geological Department, British Museum.

Science does and always must acknowledge herself indebted to those who unveil the mysteries of nature by demonstrating to us the singleness of purpose and the uniformity of the laws which have been in operation from "the beginning." In the last two numbers of the 'Annals,' Mr. Dallas favours us with a translation of Ernst Häckel's article, published in the 'Jenaische Zeitschrift,' "On the Organization of the Sponges, and their Relationship to the Corals."

Admitting that once, far away back beyond the limits of the Silurian epoch, there in all probability did exist a something equivalent to Häckel's hypothetical *Protascus*, and from which the existing stock of sponges and corals has probably been evolved (and it must not be forgotten, by the way, that the latter and by far the more highly organized of the two stocks had attained the very zenith of its development long before the epoch referred to had commenced its decline), it nevertheless forces itself upon one's mind that the evidence he brings forward in support of the supposed intimate relationship of the two groups as they *now* exist is based rather on affinities of analogy than of homology.

By the corals, as a matter of course, and in concurrence with Häckel's own rendering, is understood that section of the Cœlenterata known as the Zoantharia or Anthozoa, which forms them. Häckel, after some time spent on the examination of the calcareous sponges ("Calcispongiæ"), essays to demonstrate that the whole group of the sponges is far more closely allied to that of the Zoantharia than most modern naturalists have been inclined to allow, and that this particular section contains an existing form, *Prosycum* (Häck.), which, derived from the hypothetical *Protascus*, may be regarded as the stock-form from which all the other Calcispongiæ have been evolved.

This last hypothesis seems possible, and even highly probable; and we must not omit here to pay a willing tribute of admiration to the valuable contribution to science and the vast amount of original information Ernst Häckel's recent researches have been productive of, and this relative to a group of the Spongiadæ which up to the present time had been looked upon as very sparingly represented, but which his zealous investigations have resulted in augmenting to no fewer than 42 genera and 132 species. At the same time, however, the arguments he advances in seeking to demonstrate the close relationship of the Spongiadæ and Actinaria seem scarcely sufficient to warrant his proposed amalgamation of the two groups as sections of the same subkingdom—many of these arguments, moreover, being purely theoretical, and entirely inconsistent with the facts which have been elucidated by the investigations of other experienced naturalists.

In accordance with the opinion in the first place conceived by Leuckart, Häckel looks upon an aggregation of coral-animals, or polyp-colony, as the equivalent of a sponge-mass with its large "water-canals" opening outwardly; he, however, carries his supposition of existing homologies between the two organisms to a far greater extent than the first-named writer ever attempted to attain to.

Maintaining, in confirmation of the theory propounded by

Oscar Schmidt, that every part of the sponge-body which possesses an excurrent orifice (osculum) is to be regarded as a distinct individual, he considers each single sponge-body bearing only a single osculum, and which he denominates an individual or person, to be the equivalent of an *Actinia* or any other such solitary coral-animal—and this not only as far as their distinct individuality is concerned, but also in regard to their respective morphological characters.

The accompanying diagrammatic illustrations of sections of

Fig. 1.

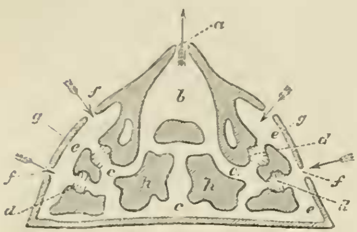

Fig. 2.

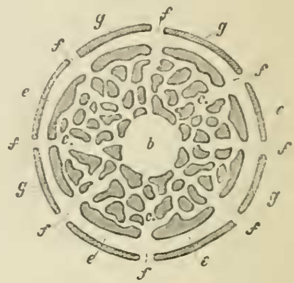

Fig. 1. Hypothetical vertical section of a *Spongilla* having a single excurrent orifice: *a*, excurrent orifice; *b*, central excurrent cavity; *c*, interstitial canal-system; *d*, ciliated chambers; *e*, intermarginal cavities; *f*, incurrent apertures; *g*, dermal membrane; *h*, deeper substance of the sponge*.

Fig. 2. Transverse section of a similar sponge; the lettering corresponds with that made use of in the last figure. It is necessary to observe that radiate symmetry has been greatly exaggerated in these two figures to adapt them as far as possible for comparison with figs. 3 & 4.

Fig. 3.

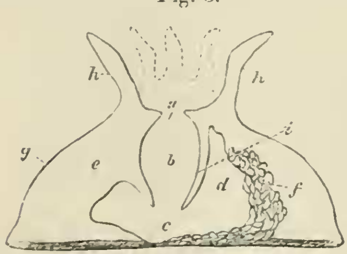

Fig. 4.

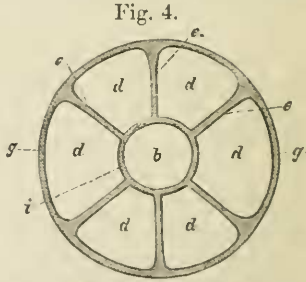

Fig. 3. Ideal vertical section of an *Actinia*: *a*, the mouth; *b*, alimentary canal or cavity; *c*, common digestive cavity; *d*, intermesenteric chamber, or portion of perivisceral cavity; *e*, a mesentery; *f*, reproductive organ; *g*, body-wall; *h*, tentacles; *i*, wall of alimentary canal.

Fig. 4. Transverse section of the same, the lettering in correspondence with the last.

* Figs. 1 & 3 are modified from illustrations given in Prof. Huxley's 'Introduction to the Classification of Animals.'

an ideal sponge-body (*Spongilla*), bearing a single osculum, and of an ordinary *Actinia* will present to the reader such analogies or homologies of form and structure as may appear to exist, and will aid materially in the institution of comparisons.

These two forms may be described as being so far analogous that, in longitudinal section, they both present the same conical outline, that the summit of each cone is provided with an aperture, *a*, and that in both instances this aperture communicates with an inferior cavity, *b*, which leads again into ulterior ramifications marked *c*, *d*; beyond this, however, analogy fails to assist us; and an inquiry into the functional properties of these regions demonstrates them to be the very opposite to homologous.

The researches of Huxley, Grant, Carter, Bowerbank, and other naturalists have long since demonstrated the essential characters of a sponge-body to be the following:—

In addition to the large apertures, or aperture, as at fig. 1 *a*, the dermal membrane, *g*, is perforated by an indefinite number of smaller ones (pores), marked *f*; these communicate (by a series of canals, of various forms and dimensions, fig. 1, *e*, *d*, *c*, which traverse the deeper layers of the sponge-body) with the osculum, *a*, by means of the central excurrent cavity, *b*. A flow of water, when the sponge-mass is in a healthy condition, is constantly setting in at the pores, drawn by the ciliary action progressing in the chambers marked *d*, and, having traversed the interstitial canals and cavities in the body-mass, debouches into the central excurrent cavity *b*, and is finally expelled from the organism at the osculum or excurrent aperture, *a**.

These currents, according to the observations of Dr. Bowerbank, are exercised in two different modes—the one being vigorous and of comparatively short duration, when the animal is feeding, and the other very gentle and persistent, and being evidently subservient to purposes of respiration only; and the last-named author, whose extensive experience with this class of animals is so eminently conspicuous in his excellent and exhaustive 'Monograph of the British Spongiadæ,' states that in no single species which he has had the opportunity of examining in a fresh and vigorous condition has he failed to detect these currents.

The same writer also ably proves that the imbibition of the surrounding fluid during the energetic action of the sponge is

* Separate ciliated chambers cannot be said to be essential to the fully developed sponge-organism, the ciliated cells in many forms being equally distributed throughout the interstitial canal-system.

equivalent to the operation of feeding in the higher classes of animals. By experiments with finely comminuted indigo placed in the water at such times, he observes that the molecules are rapidly drawn into the pores; and having undergone digestion in the sarcode lining of the interior of the sponge, the effete matter is ejected through the osculum. The fæcal matters discharged by the oscula, he adds, exhibit all the characteristics of having undergone a complete digestion; and whatever may have been the condition of the molecules of organized matter on entering the sponge, their appearance after their ejection is always that of a state of thorough exhaustion and collapse.

The foregoing facts amply demonstrate that a fully organized sponge is entirely dependent on ciliary action for its nourishment, and that the nutritious matters on which it subsists are brought to it through numerous apertures, and through the medium of a more or less complex canal-system.

Referring, now, to fig. 3, as illustrative of our second class, the Zoantharia, it will be easy to ascertain the value of the analogies of structure already noticed.

The terminal orifice, *a*, is here the sole aperture essential to the well-being of the animal. It constitutes a true buccal orifice or mouth, through which all nutrient matters have to pass to the common digestive cavity with its prolongations, *c*, *d*, through the medium of the alimentary cavity or canal, *b*, and through which again, after undergoing digestion, all effete matters are finally ejected.

This alimentary system is something totally different from what has just been shown to obtain in *Spongilla*; and comparison of the means by which the food is here brought into relationship with the digestive cavity reveals at once how essentially and insuperably the two classes are isolated from each other now, however close might have been their bond of affinity in by-gone epochs. In the sponge, ciliary action has been demonstrated to be the highest force exerted for securing the necessary sustenance for its body-mass. This force exerted, as I shall presently show there is great reason for believing, is a purely mechanical and involuntary one; but any one who has watched an *Actinia* take its food must have recognized that it achieves its end by the exercise of a force incomparably higher than that produced by the action of cilia, its prey, often living creatures almost equalling itself in dimensions, being seized and forcibly dragged, by aid of its tentacles and its prehensile, and frequently protrusible, lips which bound the aperture of the mouth, into its alimentary canal, from which it is passed on to the common digestive cavity.

The shallowness of Leuckart's hypothesis, in a measure supported by Häckel, of a polyp-colony with imperfectly separated individuals, devoid of tentacles, stomachal sac (alimentary canal), and internal septa, being the image of a sponge with its large "water-canals" (oscula) opening inwardly, here becomes most evident. Such an organism could not exist; for a polyp or polyp-colony bereft of its tentacles, and as a matter of course of its prehensile lips, though it might be hacked into somewhat the outward resemblance of a sponge, would be entirely deprived of its means of subsistence, and would, sooner or later, inevitably perish.

The few facts already adduced suffice to show that the two organisms are most distinctly and widely separated from each other. There are numerous other points, however, which can be best indicated in following up Häckel's line of reasoning, that demonstrate still further that the sponges cannot be consistently incorporated with the Cœlenterata. In the first place, Häckel endeavours to show that the peculiar canal-system of the sponges is not a perfectly specific nutritive apparatus, such as occurs in no other class of animals, notwithstanding that he at the same time admits that all recent zoologists who have gained most credit for their systematic investigations of the class consider it to be so.

In opposition to this generally received opinion, he starts with the proposition that "The sponges are most nearly allied to the corals of all organisms. Certain sponges differ from certain corals only by a less degree of histological differentiation, and especially by the want of urticating organs. The most essential peculiarity of the organization of the sponges is their nutritive canal-system, which is homologous with and analogous to the so-called gastrovascular apparatus of the Cœlenterata."

This latter portion of his proposition is certainly somewhat startling, after consideration of the facts which have been already stated. Before proceeding to bring forward his evidence in support of his rather astounding proposition, he next proceeds, somewhat prematurely, to prepare for them a snug place where they may be interpolated among, and as representatives of, the true Cœlenterata.

Such an end he achieves by entirely upsetting the clear limits by which this subkingdom is marked out and subdivided, with the mutual consent of the most eminent naturalists of the day. There is scarcely any other subkingdom which is more clearly defined, under its present limitations, than the Cœlenterata, or one that is further subdivided into two more clear and distinct sections than that of the Actinozoa and Hydrozoa.

Ignoring this system, substantiated as it is by well-marked structural characteristics, he proposes to substitute in its place one primarily dependent on mere external resemblances, thus leading us back to the same stage we had arrived at exactly one century ago.

Häckel's proposed system of redistributing the Cœlenterata is, in the first place, to separate it into two sections, which he distinguishes as bush-animals (Thamnoda) and sea-jellies Medusæ). The first of these he further separates into the two classes of the sponges (Spongiæ) and corals (Corallia), and the second into that of the umbrella-jellies (Hydromedusæ) and comb-jellies (Ctenophoræ). In which of these classes the Hydroid Zoophytes (comprising the Hydridæ, Corynidæ, and Sertularidæ) are to be included, there is no indication whatever, and it is scarcely to be inferred that he would incorporate them with the coral-forming Actinozoa.

Having viewed Häckel's elevation of the Spongiadæ to the rank of true Cœlenterates, we next search for the evidence promised in support of the very sweeping change he seeks to effect.

In the first place he states that the actual homology which he presumes to exist between the sponges and corals has hitherto been, for the most part, overlooked in consequence of the investigations of zoologists being almost entirely confined to the two common forms *Spongilla* and *Euspongia*, which he considers to differ considerably from the original and typical structure of the entire class; and he says that the legion of the Calcispongiæ is much better calculated to shed a light upon their typical organization and their true affinities. One sponge, however, belonging to his chosen legion (*Grantia compressa*, indigenous to our coasts) has formed the subject of particular investigation by Dr. Bowerbank and other naturalists; and though the different regions are modified in this species to a considerable extent, the same type of structure is essentially predominant. The central excurrent cavity, fig. 1 *b*, of *Spongilla*, for instance, is in *Grantia* developed to a marvellous extent, and this at the expense of the complex interstitial canal-system, which is almost entirely rudimentary. The functions of nutrition, however, are carried out upon precisely the same principle, the pabulum being received into the body-mass at the pores, and, after undergoing digestion, being excreted at the oscula, as in other Spongiadæ; and, in fact, this species is the form in which the ciliary action and the characteristic incurrent and excurrent flow of the water before described has been viewed with greater facility than in almost any other.

The canal-system, with the circulatory and nutritive functions dependent upon it, has, then, been demonstrated to obtain in both the calcareous and siliceous sponges, as represented by *Grantia* and *Spongilla*. Nor is evidence wanting to show that the same arrangement holds good with the third order, or *Keratosa*.

Dr. Grant, in his interesting description of the excurrent action of the sponges in general, remarks upon *Spongia panicea* as exhibiting the strongest current he ever witnessed; and, to use his own words, he says, "Two entire round portions of this sponge were placed together in a glass of sea-water, with their orifices (oscula) opposite to each other, at the distance of two inches; they appeared to the naked eye like two living batteries, and soon covered each other with feculent matter."

The whole weight of Häckel's argument in favour of the sponges being incorporated with the corals rests upon his insisting on designating the excretory orifice of the sponge its mouth or incurrent orifice, and in regarding the interstitial canal-system as homologous with the cœlenteric-vascular system of the corals. Reflection alone, in connexion with the foregoing facts, is sufficient to show his first assumption to be both inconsistent and untenable; and it is likewise a matter of no great difficulty to demonstrate that his latter assumption of homology of structure is entirely hypothetical.

Now this cœlenteric-vascular or gastrovascular system of the Actinaria, what is it? As may be shown, something far simpler than the lengthy terminology made use of by Häckel would seem to imply.

A transverse section of any Actinozoon presents us with the appearance shown at fig. 4—a double tube, the inner one of which, *b*, is the alimentary canal, and is brought into relationship by means of radiating connexions, the mesenteries, *e*, with the outer one, or body-wall of the animal, *g*. This section is supposed to be taken about halfway down in the region marked *b* in fig. 3. The six spaces marked *d*, in fig. 4, are the intermesenteric chambers; and though separated from each other by the mesenteries at this point of section, they communicate with each other freely lower down by means of the common digestive cavity, fig. 3, *c*, of which, in fact, they are simply prolongations. The region of the mesenteries, surrounding as it does the alimentary cavity or canal, is generally known as the perivisceral cavity; into this all the nutrient matters are passed, and undergo digestion, after having traversed the alimentary canal of the animal; and this is what constitutes the cœlenteric-vascular or gastrovascular system of Häckel. Such is the essential and symmetrical type of structure which obtains throughout the Actinozoa; we now turn to the sponge tribe to ascertain what its representative shares in common with it.

Fig. 2 is supposed to represent a transverse section of a highly developed sponge with a single excurrent aperture, as at fig. 1, taken through a similar region as the section at fig. 4.

A glance is sufficient to show us at once that we have here something entirely irreconcilable with what obtains in the corresponding section of an Actinozoon, and very few words will suffice to indicate how sharply defined and "thorough-going" are the points of distinction.

The most striking of all the phenomena presented are, perhaps, the perforations in the body-wall, *f, f, f* (assuming for the nonce that this sponge-body is a distinct individual); these apertures are as essential to the existence of the sponge as the single terminal buccal orifice is to the *Actinia*, and are, in fact, as has been already shown, the channels through which it derives all matters of nutrition. Next we have the interstitial system of canals pervading the whole body-mass, intercommunicating with each other in every direction, and finally debouching in the common excurrent cavity *b*. Can we be said to have here any thing homologous or even analogous to the double tube and symmetrical mesenteric system of the Actinozoon? Häckel endeavours to surmount the difficulty of this peculiar and essential incurrent porous system of the sponge by supposing the cuticular pores in connexion with the somatic cavity occasionally met with in some *Actiniæ* to be its homologue; but these cuticular pores of the sea-anemone are exceptional, and by no means an essential portion of the animal's structure, and much less are they subservient to its functions of nutrition. He presumes, again, that these cuticular pores may be constant, though hitherto unobserved, in all the Actinozoa, and that currents of water, serving respiratory purposes, are constantly passing through them into the general stomachal cavity; and taking this for granted, he, in the next paragraph, asserts, as a matter of positive fact, "that an essential morphological difference does not exist between the nutrient vascular system of the sponges and corals;" that both (solitary individuals) possess a central cavity or stomach, which opens outwards by a single large orifice (the osculum or mouth), from which cavity canals issue in all directions, which traverse the body-wall, and finally open on the surface by the cutaneous pores.

This assertion is built up on a framework of mere hypothesis; and its entire fallacy is proved by the fact that the largest section of the coral-forming Actinozoa, the whole of the Madreporaria imperforata, includes genera, such as *Caryophyllia*, *Flabellum*, *Lophohelia*, *Euphyllia*, *Phyllangia*, and numbers of others, in which the whole body-wall is strengthened by a compact and imperforate theca, which, again, is frequently rendered still more dense by the superposition of an equally compact and imperforate epitheca. A current of water passing through the body-wall into the somatic cavity of these animals would thus be a matter of perfect impossibility; and even if such did constantly exist, the perforations for its admission would be something essentially different from the apertures occupying the same position in the sponge: in the latter they have been proved to be the channels through which the body-mass derives all matters of nutrition, while in the Actinozoa they could, at the outside, be subservient only to the function of respiration; the aperture subservient to nutrition, as already shown, being the terminal buccal orifice or mouth. The very few isolated examples of the Actinozoa, however, in which these cutaneous pores have been found to exist, demonstrate beyond doubt that they cannot be subservient to so important and essential a function as that of respiration.

The next argument brought forward by Häckel appears, at first sight, to be more formidable, though on closer inspection its seeming importance vanishes. In the first place he testifies to having examined sponges whose oscula have permitted the inflow as well as the outflow of water. This condition of affairs, however, appears to have been quite an abnormal one; he cites no single instance in which the inflow of water at the osculum proved constant; and, as I shall hereafter show, this temporary and abnormal condition observed by him can readily be accounted for. The second and, seemingly, the more important part of his argument is his statement that certain sponges exist which possess no cutaneous pores at all. (The advantage his theory derives from this fact, after his assumption that all Actinozoa *do* possess them, is not clearly perceptible.) On inquiry into what sponges these are, however, we find that they consist of only two *microscopically* small forms, for one of which he proposes the name of *Prosycum*. Now the very fact of their microscopic minuteness entirely neutralizes the force of his argument, the small number of amœboid particles which must constitute so minute a sponge-mass being necessarily brought into relationship with the surrounding element without the requirement of a complex canal-system; and for the same reason, again, they find sufficient nutriment in the water around them (as with the ordinary fixed Rhizopoda, to which these low sponge-forms seem most closely to approximate) without being dependent on the action of ciliary currents.

Häckel's "ontogenetic" arguments in favour of the close relationship of the sponges to the corals next attract our attention; but whatever "phylogenetic" significance may be attached to them, it is quite sufficient to reply that evidence of affinity may be substantiated on equally strong grounds between the respective classes of the Scolecida, the Annelida, and the Echinodermata, these all originating, in common with the sponges and corals, from free-swimming ciliated larvæ in possession of a simple digestive cavity, opening outwards by a single terminal orifice.

We are now in a position to demonstrate not only that the representatives of the Porifera, or sponge-class, are quite distinct from the Actinaria or Cœlenterate coral-forming animals, but that they belong to a section peculiar in itself, and far less highly organized.

Commencing with the alimentary apparatus. It has been shown that the buccal orifice in the Cœlenterata is single and terminal. In the Spongiadæ, on the contrary, its homologue consists of a multitudinous and indefinite number of apertures which perforate the body-wall of the organism.

In the Cœlenterata this single buccal orifice is also the channel through which all excretory matters are voided. In the Spongiadæ there are distinct apertures, the flues or oscula, set apart for the purpose of carrying off the effete matters.

All Actinaria are provided with tentacles, or, where these are rudimentary, with a prehensile and protrusible buccal orifice, wherewith they sieze and secure their prey. The most highly developed sponges are dependent on the action of ciliary currents for the acquisition of the nutrient matters which support them.

This last diagnosis may, I think, be regarded as one of the highest importance,—the one force (in the case of the Actinaria) being exerted by the free will of the animal, and the other one, we have every reason to believe, being purely involuntary and vegetative. Dr. Bowerbank himself directs attention to the fact that the ciliary action which progresses within the interstitial cavities of the sponge is precisely similar in its nature to what obtains in the ciliated epithelium of the higher vertebrata; this we know to be involuntary: have we any reason for supposing that it assumes a more complex nature in the low-organized animals now under consideration? One objection that will probably be urged, as inconsistent with the theory of the sponges acquiring their nutriment through the agency of involuntary action, is the fact that at different periods the inflow of water through the pores varies much in the strength of its action. This objection, however, is easily overruled when we come to consider that the animal mass possesses such an amount of irritability and contractility in its dermal membrane that it is enabled to reduce the size of the orifices of its incurrent pores to a mere minimum, or, indeed, to close them altogether. This second condition of affairs (that of the partial closing of the pores) is actually certified by Dr. Bowerbank to exist during the less vigorous action of the ciliary currents in *Spongilla*, *Grantia*, and other genera. Now, supposing that this contraction is carried to the utmost, and the incurrent orifices are entirely closed, premising that the ciliary action, which seems to be a fair presumption, is in a constant state of progress, what result should we arrive at? The terminal osculum would alone remain open, and a sluggish current would probably set in at it, as Häckel and his pupil Miklucho testify to having occasionally witnessed; and in support of this proposed interpretation, it is a significant fact that Häckel, in recording the phenomenon of a current setting in at the osculum, makes no mention whatever of one setting out at the pores, which, had they been open, must inevitably have taken place*.

Equal in importance to the wide difference which most evidently exists between the alimentary and nutritive systems of the two classes in question, is that of the histological structure of the body-mass itself.

Häckel contends that the tissues of the sponge are as clearly separable into an ectoderm and an endoderm as are those of the

* A curious demonstration of the involuntary nature of ciliary action was brought before my notice two summers ago. Having for some time kept that interesting and abnormal Polyzoon, *Cristatella mucedo*, alive in a glass receptacle, it at length, from exhaustion of the supply of food or other causes, died, decayed, and underwent disintegration. One day my attention was drawn to the vessel which had contained it by a number of particles of organized matter of various sizes careering about in the water in a most grotesque and extraordinary manner—some propelling themselves straight ahead and simply rotating on their axes, others describing circles, parabolic and spiral curves, and a host of other figures, which even a Senior Wrangler would be puzzled to describe. Forgetting at the moment what had formerly been placed in the vessel, it first suggested itself that these were some peculiar Infusoria or larval conditions of other higher organisms; on specimens being examined with the aid of the microscope, however, the fact was revealed that they were nothing more nor less than fragments of the decomposed tentacles of the once translucent *Cristatella*, propelled through their mazy courses by the still active vibration of the cilia which clothed them. Now the thorough disintegration of these tentacles must have taken place many days, if not weeks, after the death of the animal; and the motion, moreover, continuing vigorously for a number of days after my first observation of the phenomenon, we have here proof direct of the involuntary nature of ciliary action, if, indeed, we are not justified in describing it as simply a phase of the molecular.

Actinaria: such a differentiation, however, is, to say the least of it, carried out to a considerably less degree. There are certain sponges which are invested with a pellicular and somewhat tough dermal membrane; but in the majority of instances and in the most highly organized representatives of the class, such an amount of differentiation is by no means recognizable. The new and very beautiful siliceous sponge *Holtenia Carpenteri*, recently dredged by Prof. Wyville Thomson and Dr. Carpenter in the Shetland seas, is a good example of this type of organization. A fine specimen of this highly interesting form, immersed in spirit, has recently been consigned to the National Collection; but the appearance of the body-substance to the unassisted eye is that of a simple homogeneous mass of sarcode, showing a tendency to fracture in every direction, aggregated upon the dense network of spicula which support it*, something entirely different from the appearance of an Actinarian viewed under similar conditions. This form, moreover, possessing a single very large flue or osculum, would be regarded by Häckel as correlative with a solitary *Actinia*; and the large size of this species (the body of the sponge proper measuring some four inches in both length and diameter, and having a general excurrent aperture of the width of an inch and a half) would be admirably adapted for comparison with some huge *A. crassicornis*; the differences existing between two such similar structures, however, as in the examples of *Spongilla* and an ordinary *Actinia*, have been already so clearly indicated as to render further comparison unnecessary, except, perhaps, that, in the living condition, the firm elastic ectoderm of *crassicornis* would offer a most striking and distinctive feature by the side of the low-organized and glairy sarcodic investiture of *Holtenia*.

While on the subject of the dermal investiture of the sponges, it will not be out of place to remark that in those instances where the dermal membrane attains a comparatively high degree of development, it has been observed, most generally, to possess a peculiarity essentially its own, and one not met with in any Cœlenterate organism. This is its property of being able to separate its individual component particles at any point whatever, and so form the pores, *f*, figs. 1 & 2, for

* It has been suggested to me that the spicular skeletal system of the Spongiadæ seems to indicate their close relationship to the Actinozoa. Siliceous spicula most closely resembling those of the Spongiadæ, however, are of common occurrence in that section of the true Protozoa known as the *Radiolaria*, the great spicule-secreting division of the Actinozoa (the *Alcyonaria*), on the other hand, never being found to possess any thing like an approach to such forms.

the admission of the water into the subjacent intermarginal cavities, *e*; on these becoming closed up, on account of irritation or other causes, apertures reappear, not where the original ones obtained, but at a totally different portion of the membrane. This property is essentially Protozoic. According to Häckel, the only difference in histological structure existing between the Cœlenterata and the Spongiadæ is that the representatives of the former possess nematophores or urticating cells, while those of the latter are entirely devoid of them. It must be admitted that this distinction is of itself a very important one, since it demonstrates that the former possess a much more complex degree of organization. But this is surely not all: Häckel seems to have entirely ignored the fact that the tissues of the Cœlenterata undergo a still further degree of modification, and assume the form of true unstriated muscular tissue; and in some of the higher forms (the Ctenophora) even a nervous system has been discovered.

In the sponges, on the other hand, primitive fibrous or connective tissue is the very highest degree of differentiation which obtains.

Lastly, it may be considered an open question whether a sponge-body can lay claim to the rank of distinct and separate individuality, or whether, as in accordance with the views of the majority of modern writers, it must not be regarded as an aggregation of amœbiform animals building up among themselves a common skeletal support.

This latter interpretation forces itself strongly upon one's mind when we come to consider the nature of the sarcodic substance lining all the interstitial cavities of the sponge, and spreading itself out upon and investing its horny, siliceous, or calcareous skeleton, which sarcode is capable of resolving itself into masses of unequal size and variable form, of separating itself from the parent mass and becoming developed into a perfect sponge, or of uniting with it again, or with any other individual of the same species.

In the same way with the minute sponge-particles lining the passages, each of which is capable of appropriating to itself the molecules of food brought within its reach; so that, to borrow a metaphor from Professor Huxley, when treating on *Spongilla*, "We must not compare the system of apertures and canals to so many mouths and intestines, but the sponge represents a kind of subaqueous city, where the people are arranged about the streets and roads in such a manner that each can appropriate his food from the water as it passes along."

Viewed in this light, the affinity of the Spongiadæ to the Protozoa rather than to the Cœlenterata makes itself eminently conspicuous. Compared with the latter subkingdom, it is evident that the sponges possess a very much lower degree of organization and an essentially different type of structure, while at the same time their occasionally differentiated and consolidated dermal membrane, their development, in some instances, of primitive fibrous tissue, and their complex interstitial canal-system entitle them, in a natural and morphological system of classification, to be ranked as the highest representatives of the Protozoa.

XXII.—*Descriptions of some new Species of Birds from Southern Asia.* By ARTHUR, Viscount WALDEN, P.Z.S. &c.

Sitta neglecta, n. sp.

Above pale slate-colour. Stripe from nostrils, through the eyes to nape, black. Lores, supercilium, cheeks, chin, and base of primaries white. Throat tawny white. Breast pale rufous, deepening into dark rusty on remainder of lower surface. Under tail-coverts white, with narrow rusty edgings. Middle rectrices uniform slate-colour. Wing 3 inches; bill $\frac{4}{8}$ inch.

Three examples of this Nuthatch were obtained from the Karen Hills of the Toungoo district, Burma. It differs from its nearest ally, *S. himalayensis*, J. & S., by its much stouter and longer bill, by the deep ferruginous tint of the under surface, and by the absence of a white spot on the basal half of the middle rectrices.

Passer assimilis, n. sp.

Resembles *P. cinnamomeus*, Gould, but differs by being smaller, by having a slenderer and smaller bill, and by having the cheeks and sides of the neck pure white, and the breast, flanks, and ventral region ashy grey. Wing $2\frac{5}{8}$ inches; tail $1\frac{6}{8}$, or nearly half an inch shorter than in *P. cinnamomeus*.

From Toungoo.

Glaucomyias sordida, n. sp.

General colour ashy grey, washed with a faint tinge of blue or greenish blue. Forehead, supercilium, chin, and lesser shoulder-coverts deep pure blue. Under shoulder-coverts, axillaries, vent, and under tail-coverts white. Tail brown, with a dingy gloss of dark green. Bill, legs, and claws black. Lores black. Wing nearly 3 inches; tail $2\frac{6}{8}$; tarsus $\frac{5}{8}$; fourth and fifth quills equal; third nearly as long; second still shorter